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Colonization, Culture, and Complexity

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CHAPTER 13

Prehistory of the Northern California Bight and the Adjacent Transverse Ranges

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THIS CHAPTER PRESENTS THE PREHISTORY OF THE Northern section of the California Bight and the adjacent transverse ranges, which for convenience we shall refer to as the Northern Bight. This geographic area includes the coastline from Vandenberg Air Force Base to the vicinity of Palos Verdes, as well as the Santa Ynez Range, the Santa Ynez Valley, the Santa Monica Mountains, and the Los Angeles basin. Lands at the northern margins of Ventura and Santa Barbara Counties are included as well, but archaeological data are scant for these interior lands. Also included are the Northern Channel Islands. At the time of Spanish colonization, most of these lands were occupied by the Central Chumash, and the eastern portion of this area, within the Los Angeles basin, were occupied by the Tongva (Gabrielino). Chumash descendants are numerous in the area today and have been involved in cultural revitalization throughout the twentieth century (Figure 13.1).

Research over the past 20 years, as well as the application of theoretical perspectives that have come to the fore over this period, have resulted in the acquisition of a substantially increased knowledge base for Northern Bight prehistory. Articles in prominent journals and books published by well-known presses have brought national and international visibility to the region. Underlying this significant expansion of knowledge is an increase in both the quantity and quality of data derived from the archaeological record, the dramatic increase in the number of radiocarbon dates being arguably the most important. King's (1990) chronological scheme, which is still is widely used, has been refined based on patterning in the distribution of radiocarbon dates. Other important developments are more prevalent use of eighth-inch mesh water screening, laboratory sorting of all material caught by screens, and flotation. As a result, systematic recovery of small objects such as fish bones, beads, and floral remains has opened new analytical vistas. As is true throughout California, much of this expansion and refinement of the database is a result of cultural resource management (CRM). Indeed, the bulk of research accomplished during the past 20 years, including much in academic contexts, has been driven by the objectives of CRM.

Three broad realms of theory have characterized archaeology in the Northern Bight over the past 20 years. One of these, with roots extending back to the 1950s, consists of various ecological approaches, including optimal foraging theory, related economic theories, and evolutionary ecological theory; all of these have been concerned mainly with aspects of subsistence change. The second realm of theory includes various social evolutionary perspectives on the development of sociopolitical and economic complexity. Archaeologists interested in both categories have also been interested in the role of paleoenvironmental change in altering the resource base of the prehistory of the Northern Bight. Although they are still sketchy, paleoenvironmental records coming into existence over the past 20 years have been actively applied to models of adaptive change, and there has been a good deal of lively debate concerning the nature and magnitude of the impact of environmental variability on human cultural systems. A third theoretical approach that has been slower to develop concerns the role of technological change in cultural evolution, even though technological developments have often been highlighted in arguments concerning subsistence change.

THE BEGINNINGS OF PREHISTORY

The Northern Bight has yielded some of the earliest evidence of human occupation in California, which is considered in detail in Chapter 4 of this volume. Arlington Springs Woman from Santa Rosa Island (SRI-173) is one of the earliest finds of human remains in North America (Figure 13.2). Radiocarbon dates derived from human bones as well as rodent bones from the deposits in the immediate vicinity of the human remains have yielded dates of approximately 11,000 cal B.C. (Johnson et al. 2002). On the coastal

Figure 13.1. Chumash house constructed for the 1923 Ventura county fair by Chumash descendants. Identities of men in the photograph are unknown. (Printed with permission of the Department of Anthropology, Santa Barbara Museum of Natural History, photo no. (P)NA-CA-CH-71.)

mainland opposite Santa Rosa Island, archaeological site SBA-1951 yielded a basal corner of a Clovis point (Erlandson et al. 1987), which may indicate mainland occupation of comparable age (see Chapter 5). Evidence of occupation approximately 1,500 years later has come from excavation at Daisy Cave (SMI-261) on San Miguel Island (Erlandson et al. 1996). The earliest deposits at the site appear to date as early as 9500 cal B.C. (see Table 4.1, Chapter 4), and shallower strata date between 7000 and 8000 cal B.C. (and younger). On Santa Rosa Island a buried midden exposed along the face of a sea cliff dates to 7300 cal B.C. (Erlandson et al. 1999). These finds hint at occupation of the Northern Bight coeval with the Paleo-Indian manifestations elsewhere in North America, but their scarcity and limited cultural context indicate that a good deal more work must be accomplished before this stage of prehistory can be properly understood.

On the mainland, the Surf site (SBA-931) overlooking the mouth of the Santa Ynez River has a basal stratum associated with a suite of radiocarbon dates indicating occupation between ca. 8000 and 7500 cal B.C. (Glassow 1996a:71–85). Despite deposits of this age being mixed with later deposits, the data show that inhabitants of the site collected shellfish 10,000 years ago, but the importance of other kinds of food sources, such as terrestrial mammals, is still unknown. The kinds of tools used at this time are also unknown, but the recovery of debitage indicates that they included flaked tools made of the local chert. A number of archaeologists have proposed that the lowest level (Level 1) of the Malaga Cove site (LAN-138) near Palos Verdes on the southern edge of the Los Angeles basin also is very early, perhaps coeval with the San Dieguito Complex in San Diego County (Moratto 1984:132; Wallace 1986:26). However, as Erlandson (1994:224) points out, the dating of the earliest deposits at the Malaga Cove site is unclear. They could be as early as 8000 cal B.C., but it seems just as likely that they date after 7000 cal B.C.

Coastal sites of the California Bight dating earlier than 7000 cal B.C. have been included in the Paleo-Coastal Tradition (Glassow 1996a:50), tentatively defined by Moratto (1984:104). However, sites of this age are too few and their contents too scanty to provide a meaningful regional picture of human activities. It is apparent, nonetheless, that shellfish were acquired as food resources, and data from Daisy Cave on San Miguel Island indicate that fishing with gorge and line was practiced by about 7800 cal B.C. (Rick et al. 2001). Milling implements were not used in the Northern Bight during these early times. Because population probably was at very low density and quite mobile, most or all sites would be expected to be small and to have minimal archaeological deposits (Erlandson 2000:22). Furthermore, sites of this antiquity would be most subject to the ravages of time, including destruction by coastal erosion as sea level continued to rise relatively rapidly at the end of the last Ice Age and burial under alluvial or aeolian deposits. Because the archaeological record for this earliest period is so minimal at present, little can be concluded regarding continuity between these early cultures and those after 7000 cal B.C., which are much better documented.

THE EARLIEST WELL-ESTABLISHED OCCUPATION: THE MILLINGSTONE HORIZON

Sometime between about 7000 and 6500 cal B.C. the population of the Northern Bight, as well as of the whole southern California coast, began expanding. Because sites of this age typically contain abundant metates and manos, Wallace (1954) named this period the Millingstone Horizon, which includes manifestations from San Diego through the Santa Barbara Channel. Wallace's original term has endured, with many archaeologists referring to these manifestations

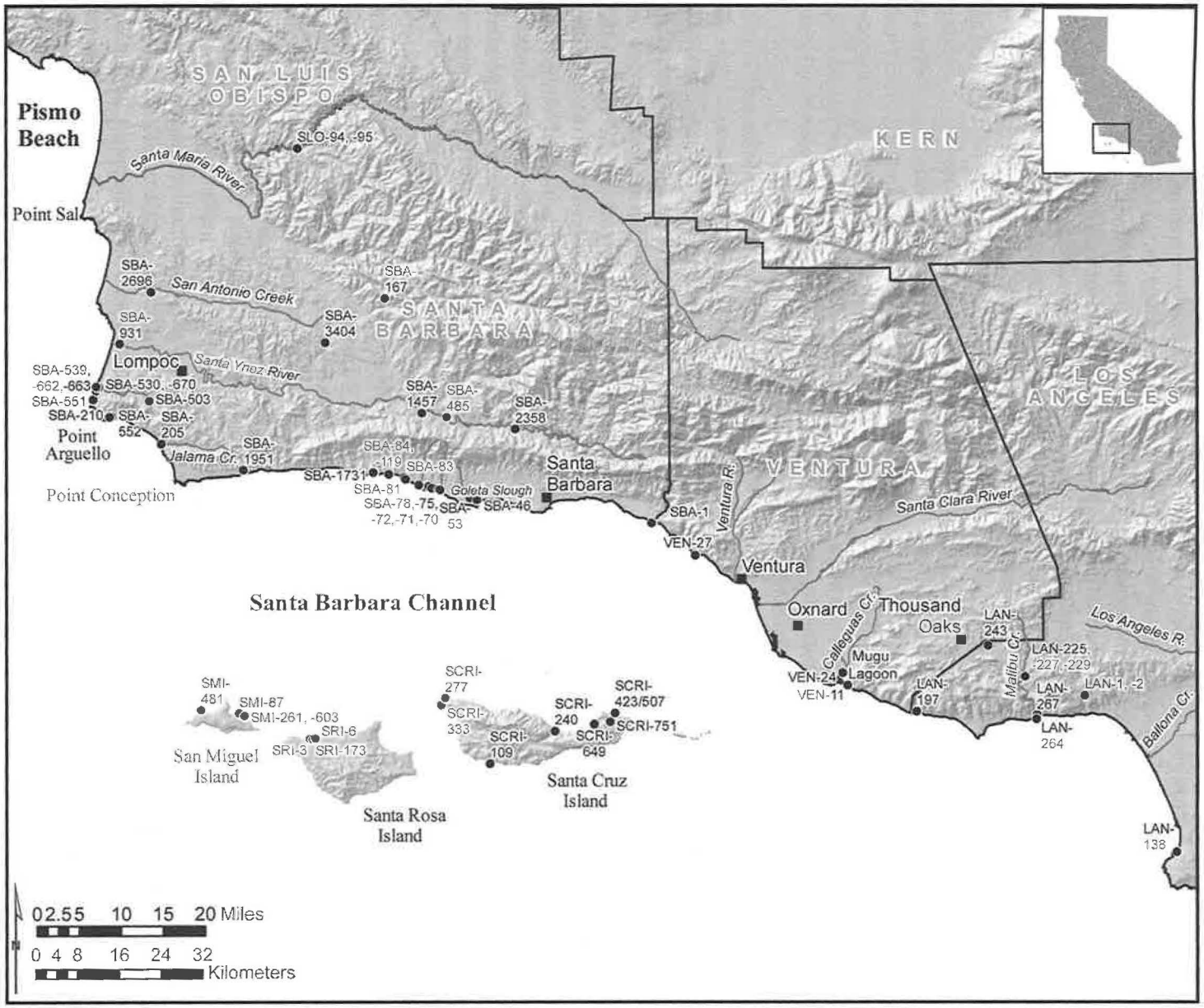

Figure 13.2. Archaeological sites and locations of the Northern Bight region.

as either the Millingstone Horizon or the Millingstone Period. Various end dates are given for the Millingstone Horizon, often as late as 3500 cal B.C. However, for several reasons, we use an end date of approximately 5000 cal B.C., which is somewhat earlier than King's end date for his Early period, Phase Ex.

Most sites known through radiocarbon dating to be of this antiquity are at or near the coast. Although the coastal zone probably supported higher population density than the interior, the smaller number of sites known to have existed in the interior undoubtedly is due to their decreased visibility and lack of easily recoverable organic remains from which radiocarbon dates can be obtained. Sites of this age adjacent to watercourses are also likely to be buried under alluvium, a result of the larger watershed sizes of interior drainages.

Only limited information is available regarding environment during this period, and some of the available data are conflicting (Glassow et al. 1988; Heusser 1978; Kowta 1969:36, 55; Pisias 1978; Warren 1968:5). A record of Holocene seawater temperature fluctuation, based on oxygen isotope data derived from a marine sediment core, indicates that water temperature was cooler and marine productivity higher than present through most of the period (Kennett 2005:66). A definitive record of vegetation characteristics during this period is yet to be developed, although some pollen data imply that vegetation communities were much as they are today (Erlandson 1994:32–33). Sea level was still rising, albeit at a much slower rate than earlier, and Early Holocene transgression into canyon mouths would have created conditions for significantly more widespread lagoons, estuaries, and tidal wetlands than was the case in later prehistory (Erlandson 1994:34; Warren 1968:6).

Despite factors that frustrate archaeologists' efforts to identify and date sites of the Millingstone Horizon, approximately 40 are known through radiocarbon dating to pertain to this time period, many more than for the period preceding 7000 cal B.C. Many sites contain substantial volumes of deposits and many hundreds of artifacts, implying regular use and longer intervals of residence annually even if populations remained relatively mobile. The site with the thickest deposits known to date to this period is located on southern Vandenberg Air Force Base (SBA-552). The lower 3.5 meters of deposits, possibly extending over an area about two hectares in size, date before 5500 cal B.C. (Glassow 1996a:87–88).

One of the difficulties with investigating sites of this age is the considerable disturbance caused by bioturbation, particularly gopher or ground squirrel burrowing. Not taking this into account has led to a number of misinterpretations of a site's archaeological record, some of which have been identified (Erlandson et al. 1988; Erlandson 1994:179–180; King 1967:62).

The most distinctive characteristic of sites dating between 7000 and 5000 cal B.C. is an abundance of metates and manos, many fragmentary. Manos are probably more abundant in site deposits than metates as a result of the former wearing out faster than the latter (Glassow et al. 1991:7,19). Hammerstones that appear to have been originally cores or core tools also are abundant in the sites and were probably used to shape metates and manos and to keep their working surfaces pitted in order to maintain milling efficacy. Substantial quantities of fist-size and larger rocks also occur, often as dense sheets in which metates and manos are mixed. Many of these rocks are fire affected, implying that they were heated stones used in baking food products, perhaps in pit ovens.

Artifact assemblages from sites of this time period also include a variety of flaked stone tools. Sites in the Santa Monica Mountains typically contain abundant fist-size plano-convex cores and core tools (often called scraper planes) of quartzite, basalt, and other volcanic stone materials as well as flake tools of the same materials (King 1967). Sites along the mainland coast of the Santa Barbara Channel and Vandenberg Air Force Base have yielded similar tools, but because of the availability of chert, many smaller flaked stone tools are also present (Erlandson 1994; Glassow et al. 1991:12.72; Owen et al. 1964). Flaked stone tools were used for cutting and scraping, but the particular kinds of material processed with them is unknown. Kowta (1969:52–53) proposed that so-called scraper planes were used to process agave and yucca leaves to extract fiber, although some probably are simply unifacial cores (Treganza and Bierman 1958:73). The abraded edges on some scraper planes and other core tools imply heavy-duty scraping, and use-wear analysis and experimentation with replicated scraper planes support Kowta's proposal (Salls 1985b). Curiously, sites of this age contain few or no projectile points, those present typically being of a leaf-shaped form reminiscent of earlier projectile points, and little evidence of biface manufacture (Glassow et al. 1991:12.71–12.73).

Artifacts and faunal remains provide information about diet, although available data have obvious biases due to differential preservation and recovery. Metates and manos indicate that various kinds of seeds and perhaps nuts were collected and milled into flour from

which food products were made. Because of better preservation, much more is known about relative importance of various types of fauna to the diet. Open coast sites frequently contain a high density of mussel shells, and often scattered Pismo clam shells as well. Shells from estuarine clams and cockles at many sites close to the mouths of canyons indicate the existence of estuaries during this period, which later became filled with alluvial deposits (Erlandson 1994:255). Bones from sites of this age are often highly fragmented. For example, deer leg bone fragments may be only a few centimeters long. Although fish bones may be underrepresented, it seems clear that fishing was not a significant enterprise (Rick and Erlandson 2000:628). Coastal dwellers may have captured fish by hand in tidal pools, but the presence of bone gorges indicates that they also practiced line fishing. Despite the problems with differential preservation of faunal remains pertaining to different taxa, Erlandson's (1994:166) analysis of subsistence practices during this time period suggests that Millingstone Horizon peoples, at least while they occupied coastal sites, depended mainly on shellfish as a source of protein, with hunting and fishing contributing relatively small amounts to the diet.

Interior areas were occupied as well, though their dating has been problematic. A substantial number of sites dating to this time period probably exist in the interior of the Santa Monica Mountains and the valleys immediately to the north. Known examples that date earlier than 5000 cal B.C. include LAN-1 (the lower component) (Treganza and Bierman 1958); LAN-225, overlooking Las Virgenes Creek (King et al. 1968); and VEN-536 (lower stratum) (Clewlow et al. 1979). In the Santa Ynez Valley, West and Slaymaker (1987) located a series of sites along the edge of Lake Cachuma (a reservoir along the Santa Ynez River) that contain milling implements and may date earlier than 5000 cal B.C. Recent test excavations at two of these sites unfortunately did not yield organic samples adequate for radiocarbon dating (Bever et al. 2004:113–115). Conway (1995) obtained a radiocarbon date of 6900 cal B.C. from charcoal associated with a stratum bearing manos at site SBA-1457, located in a tributary canyon south of Lake Cachuma. However, the charcoal for this date may be of natural origin. At SBA-485, a site overlooking the upper end of Lake Cachuma, a radiocarbon date of 5100 cal B.C. was associated with a lower stratum yielding abundant metates and manos (Otte 2001:5). Few faunal data are available from interior sites dating prior to 5000 cal B.C., but rabbits and deer were presumably important. Interior sites generally contain no shell, as would be expected, but if shellfish had been imported from the coast, their shells may have disappeared due to chemical weathering.

Sites falling into the time period between 7000 and 5000 cal B.C. also exist on the Northern Channel Islands, but the few documented so far differ from their mainland counterparts in that they contain no milling artifacts. On San Miguel Island, Daisy Cave (SMI-261) contains deposits dating within this time interval (Erlandson et al. 1996), and on Santa Rosa Island, Orr (1968:115–129; Erlandson 1991a:106–107) excavated a cemetery at which some burials date to 5900 cal B.C. (SRI-3). On both islands several other archaeological deposits have been dated to this time period (Erlandson 1991a). On Santa Cruz Island, the lowermost strata at the Punta Arena site (SCRI-109) date between 6700 and 5500 cal B.C. (Glassow 2002b), and another site on the northern coast (SCRI-277) has basal deposits dating to 5300 cal B.C. (Glassow 1980:82–83). All of these sites yielded evidence of dependence on marine resources, mainly shellfish, but including pinnipeds, fish, and marine birds. Both Daisy Cave and the Punta Arena site have yielded bone gorges dating to this period. Apparently utilization of seeds that were milled into flour was not practiced by the islanders at this time, perhaps because appropriate seed-bearing plants were not as abundant on the islands.

Sometime during this period people began to make beads from olive shells *(Olivella biplicata)* (King 1990:106–107). The most prevalent bead form is an olive shell from which the spire had been removed by either abrasion or chipping. Beads from burials show their use as personal adornment. They may be indicative of the beginnings of a regional exchange system that became increasingly more important during later periods of prehistory. King (1990:117) proposes that the comparatively few types of beads and their distribution among individual burials in cemeteries dating to the Early Period (which ended about 600 cal B.C.) generally indicate that political, economic, and religious institutions were not clearly differentiated. In other words, social differentiation was apparently minimal, and political leadership was probably weak and depended on individuals with exceptional leadership skills. Little may be added to these tentative interpretations about social organization during the Millingstone Horizon other than to propose that the group of people that occupied a residential base, perhaps not exceeding 50 individuals, probably was an extended family that was for the most part economically independent.

An issue of special significance in attempting to understand subsistence during the Millingstone Horizon is the degree to which food storage was practiced. The evidence for seed utilization is suggestive of storage because seeds may be stored for months or years if kept dry and protected from pests. The presence of storage containers or granaries would be a definitive indication of storage, but evidence of these is not likely to be preserved. Evidence of houses used by Millingstone Horizon peoples is also nonexistent except for D. B. Rogers's (1929:344) reference to settlements of "five to twenty semi-subterranean dirt-banked huts," each consisting of "a circular pit, from thirteen to fifteen feet in diameter, with perpendicular walls . . . put down to a depth of approximately thirty inches" (D. B. Rogers 1929:180; Gamble 1991:132, 153, 171).

Another fundamental issue confronting archaeologists trying to understand ecological adaptation of Millingstone Horizon peoples is the nature of settlement systems. Some archaeologists assume, at least implicitly, that the known sites of the time period are essentially a representative sample of residential bases. McGuire and Hildebrandt (1994:43), for instance, have argued that Millingstone Horizon people moved periodically from one residential base to another, each being characterized by the presence of metates and manos. They go on to argue that these sites reflect minimal gender differentiation: men and women worked together in acquiring food resources rather than men specializing in hunting and women in collecting plant food. In contrast, Glassow (1996a:130–131) argues that Millingstone Horizon sites may be a biased sample of those used through the course of an annual round of movement between resource areas. He suggests that males produced sites that are difficult to recognize or date in that they would have been hunting camps occupied for short periods of time at which little organic material usable for radiocarbon dating would have been left behind. Currently available data do not allow these two opposing hypotheses to be evaluated. Indeed, settlement systems during this time period were likely more complex than prevailing models suggest.

The Millingstone Horizon in the Northern Bight is the earliest widespread occupation that archaeological research has revealed so far, and it is a local manifestation of coastal and near-coastal occupation throughout central and southern California. The advent of a subsistence system focused on seed collecting and milling with metates and manos was most likely a revolutionary change from the past, and it appears to have allowed a much larger population to exist in the Northern Bight than previously, even though density undoubtedly was much lower than later in prehistory. Yet the origins of the Millingstone Horizon remain obscure. It may have arisen from a coastal variant of the San Dieguito Complex in San Diego County, but again, evidence is still too meager to evaluate this hypothesis.

FOUNDATIONS OF A MARITIME LIFEWAY: 4500 TO 2000 CAL B.C.

The frequency of radiocarbon-dated sites declines beginning about 6500 cal B.C. in the Northern Bight, which probably signals a decline in population due to environmental conditions that affected either terrestrial or marine resources or both. At about 4500 cal B.C., the frequency of dated sites begins to rise again, and by 4000 cal B.C. or a bit later, frequencies are at least as high as they were around 6000 cal B.C. The period of relatively lower frequencies of dated sites correlates roughly with a period of warm seawater temperatures and intermittently low marine productivity (Kennett 2005:66). Human settlement along the coast probably would have been depressed during the periods of lower productivity.

Date frequencies for the Northern Bight begin to decline again around 3000 cal B.C. or somewhat earlier, a pattern particularly apparent on the Channel Islands. As a result, the period between 4500 and 3000 cal B.C. may be seen as a relatively discrete period of prehistory during which population density apparently was higher than before or after. There is reason to suspect, however, that many of the cultural characteristics manifest between 4500 and 3000 cal B.C. persisted until 2000 cal B.C. or even later. Because few sites are known to date between 3000 and 2000 cal B.C., little archaeological information exists to clarify the nature of this continuity.

In this chapter we place the end the Millingstone Horizon at about 5500 to 5000 cal B.C. in the Northern Bight in recognition of the depressed frequencies of radiocarbon-dated sites between 5500 and 4500 cal B.C. and some significant changes in subsistence and technology, and probably also social organization evident after 4500 cal B.C. In King's (1990:28) chronological scheme, phase Eya is dated to the time interval between 4000 and 3000 cal B.C., but radiocarbon dates from Santa Cruz Island sites imply that the beginning of the phase is probably closer to 4500 cal B.C. King dated his subsequent phase, Eyb, to 3000 to 1000 cal B.C., but he had no radiocarbon dates to confirm this

time interval. Indeed, the nature of phase Eyb is poorly defined, and temporal differences will likely be discovered as more site assemblages are dated to this time interval. For current purposes, a date of 2000 cal B.C. seems reasonable as a chronological division, given that a number of sites date between 2000 and 1000 cal B.C. and are best considered in the context of later cultural development.

Although metates and manos continued in use during this time period, Gamble and King (1997:63–64) propose that both kinds of artifacts changed form, metates becoming thicker and heavier, and manos acquiring diverse shapes. It is significant, however, that mortars and pestles were added to the milling repertoire sometime around 4000 cal B.C. A few isolated instances of the use of mortars and pestles may date prior to 4500 cal B.C., the best case for which is their presence at the Sweetwater Mesa site (LAN-267). Mortars in the collection from this site have small, shallow depressions (King 1967:37–39), quite different from the large, deep depressions of later examples. The association between grinding implements (metates and manos) and pounding implements (mortars and pestles) is most evident at the Aerophysics site (SBA-53; Harrison and Harrison 1966).

We have yet to understand the use of these early mortars and pestles. Based on ethnographic data from many parts of California, some archaeologists have proposed that they were used to pound acorns and large seeds into flour, thus signaling the advent of acorns as an important food product (e.g., Gamble and King 1997:67). However, the earliest mortars and pestles may have been used to process starchy tubers or other underground plant parts, such as bulrush roots (Glassow 1996b). Regardless of the particular kinds of products processed with mortars and pestles, they undoubtedly indicate an expansion of the diet to include newly important food resources. Many sites dating to this time period contain few or no mortars and pestles and thus closely resemble sites of the preceding period in containing an abundance of metates and manos. If mortars and pestles were used at this time for processing foods present only in particular habitats, they would not be expected to occur at sites where these habitats were absent.

Another change occurring sometime around 4000 cal B.C. is a significant increase in the quantity of projectile points in site deposits. The 1956–1957 excavation at the Aerophysics site, for instance, yielded 88 projectile points (Harrison and Harrison 1966:17). The form of the projectile point is new. Instead of being leaf-shaped, it is side-notched (Figure 13.3), a form that appears to be unique to the period between 4500 and 3000 cal B.C. in the Northern Bight. The greater prevalence of projectile points may be an indication that hunting, particularly of large game animals such as deer, became more important. However, animal bones are not significantly more abundant at sites of this age than at earlier sites. If hunting was not significantly more important than it was earlier, then the greater prevalence of projectile points is likely to be related to a change in where the points were made and discarded. For instance, men may have made or discarded points at campsites during Millingstone Horizon times and then shifted these activities to residential bases beginning about 4500 cal B.C. (Glassow 1997:86–87).

More complicated settlement systems appear beginning about 4500 cal B.C. or somewhat later. The Aerophysics site is arguably the largest mainland site in the Northern Bight known to date within the 4500 to 3000 cal B.C. time period. Other sites occupied during this time period are much smaller, with a lower density of artifacts and faunal remains (e.g., SBA-75; Erlandson 1988). This distinction in site size and complexity may indicate that the Aerophysics site was a principal residential base for people living in the central Santa Barbara Channel region, perhaps occupied for relatively long periods of time during the year (Glassow 1997). The smaller sites, on the other hand, would have been occupied for much shorter periods. Nonetheless, this distinction may be due largely to variation in the diversity and abundance of resources. The immediate vicinity of the Aerophysics site offered an unusually wide variety of marshland and estuarine resources as well as diverse dry land resources, and so may have been a more popular location than others where resources were less abundant. However, the 1956–1957 collection from the Aerophysics site contains many formally shaped flaked stone tools, including bifacial drills, apparent lance points, and unifacial points (Figure 13.3) that are rare or absent from contemporaneous sites. These imply that a variety of relatively specialized activities took place at this site but not at others, thus reinforcing the idea that Aerophysics site had a special place in the settlement system.

The formal flaked stone tools from the Aerophysics site are also intriguing in that little evidence of their manufacture is present in a small sample of systematically screened deposits excavated by a University of California–Santa Barbara field class in 1985. The prevalence of small flakes less than 10 millimeters in

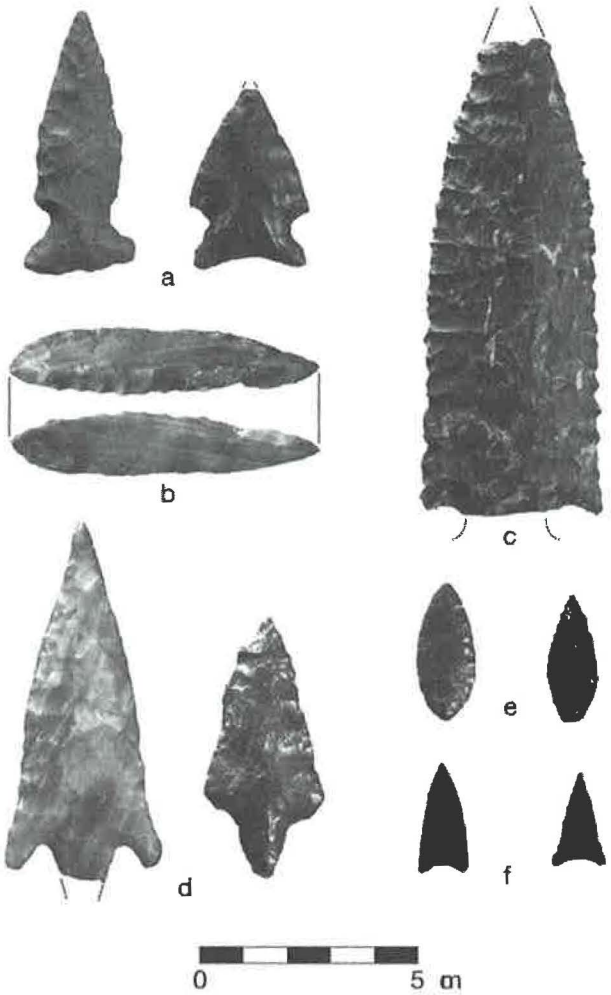

Figure 13.3. Projectile points in Northern Bight site collections. (a) Side-notched points from CA-SBA-53; (b) unifacial point from CA-SBA-53; (c) lance point from CA-SBA-53; (d) contracting-stemmed points from various sites; (e) leaf-shaped arrow points from various sites; (f) concave base (cottonwood triangular) points from various sites.

length implies that projectile points and other formal flaked stone tools were manufactured elsewhere and brought to the Aerophysics site for use. A likely possibility is the Santa Ynez Valley. Collections from site SBA-485, overlooking the upper end of Lake Cachuma, contain the same side-notched projectile points found at the Aerophysics site (Macko 1983). The two sites were probably occupied at the same time, although SBA-485 was also occupied during earlier and later periods. SBA-485 contains abundant flaked stone tool manufacturing waste and is a good candidate for a site occupied by people who also occupied the Aerophysics site. It is possible that the settlement system of the people who occupied the Aerophysics site included various coastal campsites as well as one or more residential bases in the Santa Ynez Valley.

Sites on the Northern Channel Islands occupied between 4500 and 3000 cal B.C. are distinctive in that the majority of those dated to this time period contain abundant red abalone shells. This is especially evident on Santa Cruz Island, where red abalone shells are rare at earlier and later sites. Most island sites of this time period are small, with deposits usually less than 0.5 meter thick. Typical of most Channel Island sites, mussel shell accounts for most of the shellfish remains, but the large red abalone shells are highly visible because so many are whole or nearly so. The prevalence of red abalone shells appears related to ocean waters being cooler than before or after the period when the middens were formed (Glassow 1993b; Glassow et al. 1994).

As earlier, the ecological adaptation of the islanders was clearly different from that of their coastal mainland contemporaries. One indication of this is the rarity (or even absence) at island sites of the distinctive side-notched projectile points found in contemporaneous mainland sites. Stone mortars and pestles also are typically rare or absent on the islands. Both the points and the milling implements probably were used mainly for nonmarine resources that were either absent or not abundant on the islands. For obvious reasons island populations placed a good deal more emphasis on marine resources, including fish, sea mammals, and particularly shellfish. People living at the Punta Arena site (SCRI-109) on Santa Cruz Island focused subsistence efforts on hunting dolphins, whose bones are abundant in the site's deposits (Glassow 2005). The emphasis on dolphin hunting is probably related to the proximity of a deep, steep-sided submarine canyon, a situation that does not occur elsewhere around the Northern Channel Islands. Dolphins were (and still are) attracted to this locality because of the highly productive marine life at the canyon edge due to upwelling.

Punta Arena and another site near the western extreme of the island (the El Montón site, SCRI-333; Wilcoxon 1993) are larger and have thicker deposits compared to the other Santa Cruz Island sites dated to this period. Both are situated in localities with rich and diverse marine resources, so their volume and contents may simply reflect this. However, the El Montón site is associated with a cemetery (King 1990:269–275), which implies more stable, longer-term occupation. People may have been relatively sedentary while residing at this site for part of the year but highly mobile during the remainder of the year.

A few island sites of this age have yielded digging-stick weights, attesting to the acquisition of corms,

bulbs, and/or tubers. The blue dicks corm *(Dichelostemma capitatum)* was important on the islands at the time of European colonization (Timbrook 1993:56), and most likely was utilized throughout much of the islands' prehistory.

In the only cemetery known to date to the 4500–3000 cal B.C. period, the El Montón site (Olson 1930; King 1990), increased numbers and diversity of shell beads and ornaments found with the dead suggest greater social complexity than during the Millingstone Horizon (Glassow 2004b). The nature of this complexity, however, is difficult to adduce. King (1990:95) notes that "wealth" artifacts (beads and ornaments, decorated hairpins) and ritual objects tended to be relatively more dispersed among the burials than was typical later in time (after about 600 cal B.C.), from which he infers that positions of higher status were associated with seniority and leadership ability even though society was essentially egalitarian. Some of the social complexity of this time period may be related to increased commerce between the islands and the mainland. Some of the more common objects associated with burials are hairpins, each made from a longitudinally split section of a deer metatarsal, with the bone derived from the mainland due to the absence of deer on the islands (King 1990:270–275). Increased commerce across the channel (and perhaps also between the islands), as well as the dolphin hunting undertaken by occupants of the Punta Arena site, imply that watercraft were used more intensively than before. This more intensive use may have been facilitated by technological improvements in watercraft, but no archaeological evidence yet indicates this (Glassow 2004b).

Cultural development on the islands between 3000 and 2000 cal B.C. is still poorly documented. The emphasis on collecting red abalone on Santa Cruz Island ended by about 3000 cal B.C., and none of the 13 sites with abundant red abalone shells has evidence of occupation continuing after this date (although a few have overlying deposits dating much later in time). Most likely coastal mainland settlement underwent a similar disruption, but rodent burrowing and other types of disturbance to sites have so far prevented assessment of this possibility. King's (1990) analysis of Channel Islands cemetery collections indicates a good deal of continuity in such items as shell beads and ornaments, hairpins, and ritual objects from the period before 3000 cal B.C. to possibly as late as 1000 cal B.C. (the end of his phase Eyb). This implies that despite environmental changes affecting the availability of red abalone, craft production and social and economic organization remained unchanged. As mentioned above, however, the side-notched projectile point was no longer made after about 3000 cal B.C.

Beyond the Santa Barbara Channel mainland coast and the islands, comparatively few sites in the Northern Bight are associated with radiocarbon dates falling within the 4500 to 2000 cal B.C. time period. Nonetheless, many sites have yielded large side-notched points of the type in the Aerophysics site collections, indicative of occupation between 4500 and 3000 cal B.C., although most have deposits in which artifacts of this time period are mixed with earlier or later deposits or both. Indeed, some sites were probably occupied at different times beginning as early as 7000 cal B.C. and extending as late as 2000 cal B.C. or even later. Examples include SBA-485 in the Santa Ynez Valley and the Tank site (LAN-1) in Topanga Canyon. In the case of the latter site, however, there is a stratigraphic distinction between deposits that date earlier than 5000 cal B.C. and those that date later.

Along the coast north of Point Conception, side-notched points came from excavation at a site at Jalama Beach (SBA-205) (Lathrap and Hoover 1975), but they occur in a stratum of deposits that contains evidence of later occupation as well. To the north, on Vandenberg Air Force Base and in the vicinity of Lompoc, occupation during this time period is represented by radiocarbon dates and finds of the distinctive side-notched projectile points at several sites (Glenn 1991). However, collections from deposits of this age are not large and in some cases are not clearly differentiated from earlier or later deposits and/or are not well dated (e.g., basal deposits at SBA-210). An exception is two side-notched points from a recent investigation at SBA-530, overlooking the mouth of Honda Canyon. These were found in deposits clearly dating between 4200 and 3000 cal B.C.

Overall, the period between 4500 and 2000 cal B.C. is pivotal in many respects in that a number of changes that took place presaged later cultural development, particularly before 3000 cal B.C. Mortars and pestles, for example, were used for the first time, indicating that diet included a greater variety of plant foods. Higher frequency of projectile points implies either a greater emphasis on terrestrial hunting, a major shift in gender-based division of labor, a shift in the nature of settlement systems, or some combination thereof. Increased use of watercraft and perhaps design improvements are implied by the emphasis on dolphin hunting at one island location, expansion of fishing practices to include offshore species, and the presence

in island sites of various artifacts made of deer bone from the mainland. Finally, mortuary practices suggest greater emphasis on status differentiation, perhaps associated with larger leadership roles. A decline in population after 3000 cal B.C. is apparently associated with an environmental shift not yet well understood.

MARINE AND TERRESTRIAL TRANSITIONS FROM THE MIDDLE TO LATE HOLOCENE, 2000 CAL B.C. TO CAL A.D. 1

Spanning the transition from the Middle to Late Holocene (1500 cal B.C.), this time period follows the adoption of mortars and pestles, includes the transition to circular shell fishhooks around 500 cal B.C., but precedes the introduction of the plank canoe and bow and arrow around cal A.D. 500 (Erlandson 1997a; Glassow 1996a). In addition to significant shifts in subsistence and increased coastal settlement around 2000 to 1000 cal B.C., artifact analysis from habitation and burial sites reflects cultural elaboration, indicating a transition from egalitarianism to achieved differences in wealth and status (Erlandson and Rick 2002a; Hollimon 1990; King 1990; Lambert 1994; Lambert and Walker 1991). Changes in technology, subsistence, and settlement from 2000 to 1000 cal B.C. reflect an increasingly maritime orientation, with intensified fishing and regional exchange arguably providing the basis for subsequent socioeconomic and political complexity in the region.

Over the past 20 years, the archaeological record for the period between 2000 and 1000 cal B.C. has been augmented substantially by survey and excavation on the Northern Channel Islands and along the mainland coast. Fifty-four sites have components radiocarbon dated to this time period. Relevant archaeological data for the western extreme of the Northern Bight are limited primarily to Vandenberg Air Force Base, and studies in the Santa Ynez Valley and elsewhere in the interior are limited for many of the reasons mentioned earlier. Despite growing contributions from mainland excavations, the majority of sites with components dating between 2000 cal B.C. and cal A.D. 1 have been identified on the Northern Channel Islands. Relative to the other islands, Santa Cruz Island has the largest number of relevant sites (23) because of its larger size and more protracted history of archaeological investigations by a greater number of researchers. Most of these sites are located in coastal settings west of the narrow neck (isthmus) of the island, but 10 sites have been identified on eastern Santa Cruz Island through investigations beginning in the early 1990s.

Based on faunal data from sites throughout the Northern Bight, one of the most significant shifts in subsistence between 2000 cal B.C. and cal A.D. 1 is the well-documented broadening of diet to emphasize a diverse array of marine and terrestrial habitats and species (Erlandson 1997a, b; Erlandson and Rick 2002a; Glassow 1996b, 1997; Kennett 1998, 2005; Perry 2003; Vellanoweth et al. 2000). Coastal and island populations diversified their technologies and subsistence practices substantially to emphasize pulpy plant foods such as acorns, islay, and roots (tubers, corms, and bulbs), as well as fish and sea mammals (Glassow 1996b, 1997). As processing implements for a variety of plants and small fauna (e.g., rabbits, shellfish), mortars and pestles, of more refined forms than earlier, were among the tools that made such diversification and subsequent resource intensification possible.

Technological innovations appearing in the archaeological record of the Northern Bight between 2000 cal B.C. and cal A.D. 1 include contracting stem points (Figure 13.3), notched stone sinkers or net weights, and circular shell fishhooks, all of which directly transformed hunting, fishing, and possibly dimensions of violence (Erlandson 1997a; Glassow 1997). The transition from side-notched dart points to contracting stemmed points around 2000 cal B.C. may reflect shifts in hunting and/or warfare strategies, with Glassow (1997) emphasizing the advantages of attachment between the point and shaft through the application of asphaltum. Concurrent with this development are some of the earliest examples of asphaltum basketry impressions and tarring pebbles, indicating that asphaltum was used for a range of tool manufacturing purposes for at least 4,000 years (Erlandson 1997b; Erlandson and Rick 2002a:170). Artifacts from SBA-1900, a site occupied between 1500 and 1000 cal B.C., reflect the range of technologies available at this time, including metates and manos, mortars and a pestle, charmstones, a notched cobble net sinker, contracting stem points, tarring pebbles, and asphaltum-stained cobbles (Erlandson 1997b:99).

Notched stone sinkers or net weights around 2000 to 1000 cal B.C. and circular shell fishhooks around 500 cal B.C. provided opportunities to diversify marine resource use from the overwhelming emphasis on shellfish that characterized the Early and Middle Holocene (Erlandson 1997a, b; Glassow 1993a, 1996a; Kennett 1998). Late Holocene subsistence appears to be much broader as fishing efforts were expanded (e.g., kelp bed and midchannel fishing) and intensified (e.g., nearshore netting) to varying degrees

throughout the Northern Bight (Erlandson and Rick 2002a; Glassow 1993a, 2002a). Such changes are well represented in the mixed diet of Middle to Late Holocene deposits at Cave of the Chimneys (SMI-603) on San Miguel Island (Vellanoweth et al. 2000:612). At this site, faunal remains from three strata dating to 4000, 3800, and 2500 RCYBP reflect the diminished importance of shellfish from 83 percent to 25 percent and a concomitant increase in fish from 17 percent to 52 percent of the meat yield. Relevant faunal data have also been obtained from Daisy Cave (SMI-261) in deposits dating between 800 and 3000 RCYBP (Vellanoweth et al. 2000) as well as more recently from SMI-87 and 481 (Rick 2004a, b).

Similar trends have been identified in Middle to Late Holocene deposits at sites throughout Santa Cruz Island and Santa Rosa Island, where Glassow (1993a), Kennett (1998), Perry (2003), and others have documented a significant increase in fishing after about 1000 cal B.C. The most comprehensive subsistence data for this transition are presented by Glassow (1993a) with respect to Santa Cruz Island and by Kennett (1998, 2005) based on sites located there and on Santa Rosa Island. Of the 12 sites discussed by Glassow (1993a), six have subsistence data for components dating between 2000 cal B.C. and cal A.D. 1. Deposits dating between 2000 and 500 cal B.C. are dominated by shellfish, which represents between 70 percent and 96 percent of the protein yield, with fish contributing between 1 percent and 30 percent. In contrast, for those dating after 500 cal B.C., shellfish represents between 9 percent and 70 percent (primarily under 45 percent) of the protein yield and fish between 18 percent and 80 percent (Glassow 1993a:79). Kennett (1998:277, 327; 2005:189–192) also documents intensified fishing through time with similar variability with respect to the relative contributions of shellfish and fish at different sites.

Along the coastal mainland south of Point Conception, Erlandson (1994, 1997b), Glassow (1997), and Erlandson and Rick (2002a) have observed a similar shift in the relative importance of fishing. Erlandson (1997b) discusses the distribution of sites dating between 2300 and 1100 cal B.C. along the coastline south of Point Conception, such as SBA-1808, 1900, and 2067 along or near Gaviota Creek, which have yielded evidence for shellfish comprising 50 to 70 percent of the edible meat represented by faunal remains. Meat contributions from fish (including nearshore sandy bottom species) and sea mammals are variable, ranging to as much as 30 percent and 50 percent respectively, with land mammals such as deer and rabbit also represented in the diet. At these sites there is also evidence for plant exploitation, based partly on the identification of abundant ground stone implements but also 17 burned rock features at SBA-2067, which Erlandson (1997b:99) suggests may have been used for cooking *Yucca whipplei*. In contrast, Late Holocene deposits at four coastal sites, SBA-72S, 1491, 1731, and 2149, indicate the diminished importance of shellfish, representing no more than 13 percent of the protein yield, whereas fish contributions vary between 17 percent and 75 percent and sea mammals between 4 percent and 47 percent (Erlandson and Rick 2002a:176). In sum, faunal data from Middle to Late Holocene deposits at these and other sites south of Point Conception, such as SBA-84 at El Capitan State Beach (Glassow 1992), have been interpreted similarly to island data, in that fishing and sea mammal hunting were intensified after 1000 cal B.C. to varying degrees depending on site location among other factors.

Based on extensive survey and excavation on Vandenberg Air Force Base, subsistence patterns north of Point Conception differ from both the islands and mainland to the south, especially with respect to the role of fishing (Glassow 1996a, 2002a). At sites throughout the region through time, shellfish were an essential component of the diet, with California mussel *(Mytilus californianus)* representing 80 percent or more of the protein yield at SBA-210, 530, 539, 551, 552, 663, and 670 (Glassow 1996a:124). Excluding SBA-552 and 663, the rest of the sites have components dating between 2000 cal B.C. and cal A.D. 1, in which California mussel is the dominant species (Glassow 1996a:125). Although fishing was intensified, particularly after cal A.D. 500, it was never comparable to that conducted south of Point Conception. At five of the sites (SBA-210, 530, 539, 551, and 670), fish contributed no more than 14 percent of the dietary protein regardless of time period (Glassow 1996a:125). Sea mammal hunting fluctuated in importance through time, but was apparently intensified from about 200 cal B.C. to cal A.D. 1100 based on the relatively higher proportions of sea mammal bone from upper deposits at the same sites (Glassow 2002a:189). Terrestrial resources were more limited along the coastline of Vandenberg Air Force Base, with plants such as oaks being extremely rare within 10 kilometers of the coast due to the strong winds and fog that characterize this region (Glassow 1996a:6).

Alongside changes in subsistence is evidence for increased sedentism and cultural elaboration around

2000 to 1000 cal B.C. throughout the Northern Bight (Erlandson 1997a, b; Erlandson and Rick 2002a; Glassow 1997; King 1990). On the Northern Channel Islands and coastal mainland, increased sedentism is associated with an intensified marine-oriented economy as larger settlements were established directly on the coast to access increasingly maritime opportunities (Gamble and King 1997; Gamble and Russell 2002; Kennett 1998, 2005; Kennett and Conlee 2002; Munns and Arnold 2002; Perry 2003, 2004). Gamble and Russell (2002:107) summarize King's (1990) assessment of changes in settlement from 3500 to 600 cal B.C., which he interprets as trending toward a greater emphasis on boats and ocean resources, increased regional organization and larger populations, and less emphasis on defensive locations by 600 cal B.C. (Kennett 1998). This pattern is well documented on eastern Santa Cruz Island where spatial distribution of 90 temporal components at 66 sites representing occupation from 6000 cal B.C. to historic times indicates that the shift to coastal residential bases occurred after 500 cal B.C. (Perry 2003, 2004).

Increased sedentism between 2000 cal B.C. and cal A.D. 1 is evident at coastal sites throughout the region based on their increased size and/or high density of faunal remains and artifacts, floral assemblages indicative of year-round habitation, formal architecture including large clusters of semisubterranean houses and ceremonial structures at sites such as SBA-81 in Las Llagas Canyon, and formal cemeteries (LAN-2, 197; SBA-1, 71, 81, 119; SCRI-333; and SRI-41) (Erlandson 1997b; Erlandson and Rick 2002a:179; Gamble and Russell 2002:108; Glassow 2002a). Several coastal sites were occupied, at least seasonally, from 2000 cal B.C. to cal A.D. 1 through historic times, such as Xaxas (SCRI-240) at Prisoner's Harbor and Swaxil (SCRI-423/507) at Scorpion Anchorage on Santa Cruz Island as well as at Noqto (SBA-210) south of Point Arguello and SBA-72 in Tecolote Canyon on the mainland (Arnold 1987, 2001c; Erlandson and Rick 2002a; Glassow 1996a; Kennett 1998). Seemingly continuous occupation from 1200 cal B.C. into historic times of the historic village and major trade port of Xaxas on the north side of the island is based on more than 20 radiocarbon dates and temporally diagnostic artifacts (i.e., beads and microdrills), highlighting the ongoing role this location played in the increasingly maritime economy (Arnold 1987, 2001c:48; Arnold and Graesch 2001; Arnold et al. 2001; Kennett 1998, 2005; Preziosi 2001).

Settlement trends north of Point Conception differ from those evident to the south and on the Northern Channel Islands in at least two significant respects. First, inhabitants of the Vandenberg region engaged a much higher degree of residential mobility through time (Glassow 2002a). Second, of the known residential bases, most are in the interior with few situated directly on or near the coast because of the strong northwest-prevailing winds, fog, cool temperatures, severe winter storms, and intense wave action that characterize the Vandenberg coastline (de Barros et al. 1994:2–1). The exceptions are sites located along south- to southwest-facing expanses of coastline, particularly those adjacent to Point Sal and Point Arguello, which provide protection from the strong northwesterly winds and heavy surf (Glassow 1996a). Along a stretch of south-facing coastline east of Point Arguello is the historically documented village of Noqto (SBA-210), which also contains Middle Holocene deposits dating to about 5,000 years ago, this long span of occupation highlighting its ongoing importance in the regional settlement-subsistence system (Glassow 2002a:192). However, the most substantial residential bases during the Late Holocene are found in the most hospitable interior locations along drainages that were convenient access routes between these sites and the coast, such as SBA-2696 situated 15 kilometers inland along San Antonio Creek (Colten et al. 1997; Glassow 2002a).

Regardless of such regional differences, it is apparent that resource diversification, including intensified fishing and coastal sedentism, are associated with changes in social organization and ideology between 2000 cal B.C. and cal A.D. 1. Coastal sites throughout the Northern Bight have yielded substantial evidence for status differentiation and ritual behavior, including ceremonial enclosures and formal cemeteries with a wide range and abundance of beads, ornaments, and ritual items (Erlandson and Rick 2002a; Lambert 1994; Lambert and Walker 1991). Furthermore, artifacts similar to those ethnographically associated with ritual behavior have been recovered from the mainland and Santa Cruz Island, including "eagle or bear claws, charmstones, pipes, bone tubes, whistles, and quartz crystals" at the cemeteries at SBA-81 and SBA-119 (Erlandson and Rick 2002a); deer tibia whistles, quartz crystals, and turtle shell rattles recovered from burials at SCRI-83 assigned to the period between 1400 cal B.C. and cal A.D. 300 (Hollimon 1990, 2004; Corbett 2004); and incised stones at SBA-210, SCRI-649, and SCRI-751 (Bury et al. 2004; Perry 2003). In addition, at least one rock art site, Swordfish Cave (SBA-503) in Honda Canyon on Vandenberg Air Force Base, is associated with this period, based on the presence of red

ochre in deposits dating between about 1600 and 1450 cal B.C. (Lebow and Onken 1997).

Noting the correlation between artifacts dating to this time and those historically documented as being associated with high-status individuals, including ritual items, Erlandson and Rick (2002a:181) observe that "these parallels with ethnographic Chumash practices, along with clear evidence of an elaborate and diversified material culture, suggest that fundamental aspects of Chumash society emerged near the end of the Middle Holocene or early in the Late Holocene." The abundance of social and ideology-related features and artifacts, along with the production of rock art, implies that changes in status and power were occurring in Santa Barbara Channel region. King (1990:162) interprets such evidence as power being concentrated in informal ritual and political organization in contrast to the ascribed status, formalized political leadership, and rise of secular power through exchange interaction that characterized the past 1,000 years (Arnold and Green 2002; Gamble et al. 2001, 2002).

When accounting for such transformations, researchers have tended to invoke fluctuating environmental conditions and increasing population density as factors related to technological innovation and shifts in settlement and subsistence strategies. Based on paleoenvironmental data, oak woodlands and other plant resources were distributed extensively between 2500 and 1300 cal B.C., when the "warmest and most climatically variable intervals during the Holocene occurred" (Kennett 1998:245; Kennett and Kennett 2000). Following the earlier introduction of mortars and pestles, technological innovations between 2000 cal B.C. and cal A.D. 1, such as contracting stemmed points and the more intensive and diverse use of asphaltum, broadened opportunities to exploit changing terrestrial and marine habitats, resulting in the inclusion of lower-ranked resources in the diet (Glassow 1997). Furthermore, net weights, fishhooks, and later plank canoes promoted development of a maritime-oriented economy, with intensified fishing and trade underwriting coastal and island sedentism and specialization (Arnold 1995, 2001a, b; Arnold and Bernard 2005; Colten 2001; Erlandson and Rick 2002a; Hudson et al. 1978; Kennett 1998, 2005; Pletka 2001).

Erlandson and Rick (2002a:180) suggest that resource diversification, sedentism, and cultural elaboration between 2000 cal B.C. and cal A.D. 1 correspond with slightly increased population densities, although substantial population growth probably did not occur until after cal A.D. 500 (Glassow 1999). With recent radiocarbon dates adding to the number of sites representing this time frame, it appears that increasingly dense and permanent settlements along the coast, and resulting territorial circumscription, likely contributed to further resource intensification, increased socioeconomic interaction and differentiation, and competition and violence, all of which are evident in sites dating between 2000 cal B.C. and cal A.D. 1 (Erlandson 1997a; Erlandson and Rick 2002a; King 1990; Lambert 1994; Lambert and Walker 1991; Walker 1989). In sum, recent archaeological research has contributed significantly to the understanding that the hallmarks of historically documented complexity are rooted in significant technological and demographic transformations beginning 4,000 years ago along the coastlines of the Northern Bight.

IMPORTANT TECHNOLOGICAL AND SOCIAL DEVELOPMENTS, CAL A.D. 1 TO 1000

Several additional significant cultural changes occurred during the period between cal A.D. 1 to 1000, the full contexts of which are not yet well understood. Other changes are best characterized as continuations of development beginning during earlier periods. According to Kennett's seawater temperature curve (Kennett 2005:66), this period is transitional between moderately warm conditions to increasingly colder conditions, along with increasingly variable marine productivity during the second half of the period. Cultural responses to these changing conditions are not yet apparent, nor are the climatic conditions that may be associated with these water temperature fluctuations (Gamble 2005).

As was the case during the latter part of the preceding period, the substantial accumulation of midden deposits at some coastal sites indicates increasing sedentism. This is also reflected in the presence of well-developed cemeteries, some being relatively large. Examples are SBA-81 with 364 burials, SBA-71 with 75 burials, and SRI-6 with 221 burials. According to King (1990:34–35), these cemeteries date between cal A.D. 1 and 700. It also seems that population was growing substantially through this period, especially after about cal A.D. 500, as indicated by increasing frequencies of radiocarbon-dated site components (Glassow 1999).

Arguably the most significant change during this time interval is the introduction of the plank canoe, or *tomol* as it was known on the mainland at the time of European colonization. King (1990:85) proposed that the plank canoe began to be manufactured sometime around cal A.D. 500, basing his argument on the

earliest available dates for a distinctive type of flaked chert drill. He proposed that these were appropriate for drilling the holes in the wood planks of which the canoes were constructed. On the basis of available archaeological evidence of plank canoe manufacture, Gamble (2002b) concluded that the earliest evidence may be a few hundred years later. However, Arnold (1995:736; Arnold and Bernard 2005) suggested that the plank canoe was developed at a somewhat later date on the basis of other kinds of evidence, such as the temporal occurrence of swordfish bones and trade goods. Gamble (2002b:313) points out that sewn-plank watercraft technology existed in Polynesia and that Polynesian contact with the people of the Northern Bight is possible, although she states there is little archaeological evidence to support this. The idea that the Chumash plank canoe may be a result of contact with Polynesians has recently been taken up by Jones and Klar (2005; Klar and Jones 2005).

The immediate impact of the development of the plank canoe is not completely apparent, although a noticeable increase in the acquisition of large deep-sea fish such as tuna and swordfish appears to be one result (Arnold and Bernard 2005; Bernard 2004; Davenport et al. 1993; Gamble 2002b). King (1990:85) notes that within a few hundred years after the introduction of the plank canoe, harpoons began to be made, and he proposes that their use would have required such a watercraft.

As discussed later, the plank canoe became important in commerce between the mainland coast and the Channel Islands, and it also became important in fishing. It is possible that moderate expansion in these activities did take place once the plank canoe began to be used, but it seems that the full potential of the plank canoe was not realized until later in prehistory. King (1990:85) suspects that the tule balsa was used prior to the plank canoe, but if so it was of a type reasonably well adapted for channel crossings. It is also possible that some sort of more sophisticated watercraft was in use immediately prior to the introduction of the plank canoe.

Another technological change with important implications is the introduction of the bow and arrow, which replaced the throwing stick (atlatl) and dart sometime around cal A.D. 500 or shortly thereafter, as it did in other parts of California (Moratto 1984:283, 338, 420). Evidence for the introduction of the bow and arrow is a marked decrease in the size of projectile points. The earliest well-documented arrow points are leaf shaped (convex base) in form (Figure 13.3), and it is the dominant form at SBA-117, the basal deposits of which have yielded a radiocarbon date of about cal A.D. 500 (Glassow 1992:113). A square-stemmed form of arrow point possibly also was made in some parts of the Northern Bight (e.g., at VEN-61 near the city of Ojai) (Susia 1962:168), but its temporal placement relative to the much more prevalent leaf-shaped form remains uncertain. Asphaltum was used in attaching leaf-shaped points to arrow shafts, as was the case with the earlier dart points.

As Bradbury (1997:210) points out, the bow and arrow would have been superior in warfare to the throwing stick and dart, and as discussed later, the role of the bow and arrow in intergroup competition within the Santa Barbara Channel region became apparent after cal A.D. 1000. This new weaponry also was used in hunting large game, but it is not yet clear whether subsistence was affected by this technological shift.

King's (1990:99, 228–229) analysis of shell beads from Santa Barbara Channel sites revealed that the production of *Olivella* wall beads, most being a type known as saucers, expanded dramatically near the beginning of this period. Another expansion in the intensity of bead making occurred near the beginning of the next period, considered below, although Kennett (2005:202) proposes that it began as early as cal A.D. 700. King also documents an elaboration in various kinds of bone and stone ornaments and ritual items at the beginning of the period. He (1990:99) proposes that the distribution of beads and ritual objects among burials and within particular localities within a cemetery indicates social differentiation among elite individuals within a village society. He suggests that control of political and economic decision making was in the hands of one group of elite individuals and control of ritual activities was in the hands of another. Regardless of whether this proposal is ultimately supported by additional data, it seems likely that social differentiation increased significantly at the beginning of this period. Other manufactured items, such as stone mortars and pestles, are carefully made but do not appear to be significantly more elaborate than those of the preceding period.

The period between cal A.D. 1 to 1000 was one of significant changes in technology, society, and economy. It is a period in which regional populations apparently grew to much higher levels and several important steps were taken along the road to increasing social and economic complexity. The period clearly deserves more attention than it has received up to now in order

to understand the contexts of these changes and their implications for future cultural development.

COMPLEXITY AND CLIMATIC CHANGE, CAL A.D. 1000 TO MISSIONIZATION

At the time of European colonization, the western portion of the Northern Bight was occupied by the Chumash and the eastern portion by the Tongva, who spoke one of the southern California Takic languages. Tongva territory included the Los Angeles basin, the eastern Santa Monica Mountains, and the San Fernando Valley and the hills immediately to the north (Figure 13.4). The Chumashan and Takic language groups are unrelated, yet similarities in their material culture (Hudson and Blackburn 1979:17-41) are testimony to the social and economic relations that linked the Chumash and Tongva. The largest villages and the zone of highest population density existed along the mainland coast of the Santa Barbara Channel between the cities of Carpinteria and Goleta, with village populations reaching as high as 500 to 800 individuals. Interior villages varied considerably in size, the largest being in the Santa Ynez Valley with populations of 150 to 250, and the smallest in remote corners of the interior with populations of 15 to 30 (Applegate 1975; Brown 1967).

All major aspects of Chumash and Tongva cultural systems as they were at the time of European contact were in place by cal A.D. 1300, and considerable research over the past 20 years in the Northern Bight has been concerned with clarifying the nature of cultural complexity during the post cal A.D. 1300 period and the various factors that led to this complexity during the preceding few hundred years. Much of this research has been focused on the effects of climatic and environmental change on the development of complex sociopolitical and economic systems, particularly among coastal populations of the Santa Barbara Channel (Arnold 1992a, 2001c; Gamble 2005; Glassow 1996a; Johnson 2000; Kennett 1998; Kennett and Kennett 2000; Lambert 1994; Raab et al. 1995; Raab and Larson 1997).

Arnold (1987, 1992a; 2001c) was among the first to propose that climatic conditions had a deleterious effect on Santa Barbara Channel populations, suggesting that an unfavorable warm water period between cal A.D. 1150 and 1250 on the Northern Channel Islands created adverse environmental conditions. As a result, sometime between cal A.D. 1200 and 1300 a ranked society emerged. Arnold proposed a new chronological period, the Middle/Late Transition (cal A.D. 1150–1300), which encompassed the changes that occurred during this time interval. In contrast to Arnold, Raab and his colleagues (Raab and Larson 1997; Raab et al. 1995) proposed that droughts, some severe, occurred intermittently during the longer period known as the Medieval Climatic Anomaly (Jones et al. 1999; Stine 1994) between cal A.D. 800 and 1400, these affecting terrestrial resource productivity and freshwater availability. On the basis of seawater temperature and marine productivity records, Kennett and Kennett (2000) proposed that high marine productivity and sustained terrestrial drought occurred between cal A.D. 450 and 1300. It is significant that the Medieval Climatic Anomaly began over 300 years before the Middle/Late Transition and may have played a significant role in the development of social complexity before the Middle/Late Transition. These scholars, as well as others including Walker and Lambert (1989), Colten (1993, 1995), Lambert (1994), Johnson (2000), and Glassow (1996a), hypothesized that socioeconomic complexity arose at least in part as a result of environmental stress that led to social hierarchy and greater complexity.

Gamble (2005) has suggested that solid chronological evidence for long-term climatic change followed by punctuated cultural adjustments is lacking. She has countered the environmentally based arguments by pointing out that hunter-gatherer societies such as the Chumash developed a multitude of adaptive strategies to cope with periodic droughts, El Niño events, and other environmental perturbations. She concurs with King (1990), who has suggested that cultural change was more gradual. An understanding of the basis for these varying viewpoints requires consideration of the results of archeological research accomplished over the past few decades that has focused on the latter part of the Middle Period, the Late Period, and the nature of Chumash sociopolitical organization at the beginning of European colonization.

An important key to understanding social complexity is the nature and scope of craft specialization. The archaeology and ethnohistory of Santa Cruz Island provided some of the first evidence of this. King (1976) compiled evidence of craft specialization on the island in his elucidation of intervillage exchange networks within regions occupied by the Chumash people, which King defined as three major ecological zones, the Northern Channel Islands, the mainland coast, and the interior (or inland area). Later research by Arnold and her colleagues yielded details of the nature of craft specialization (Arnold 1987, 1992a;

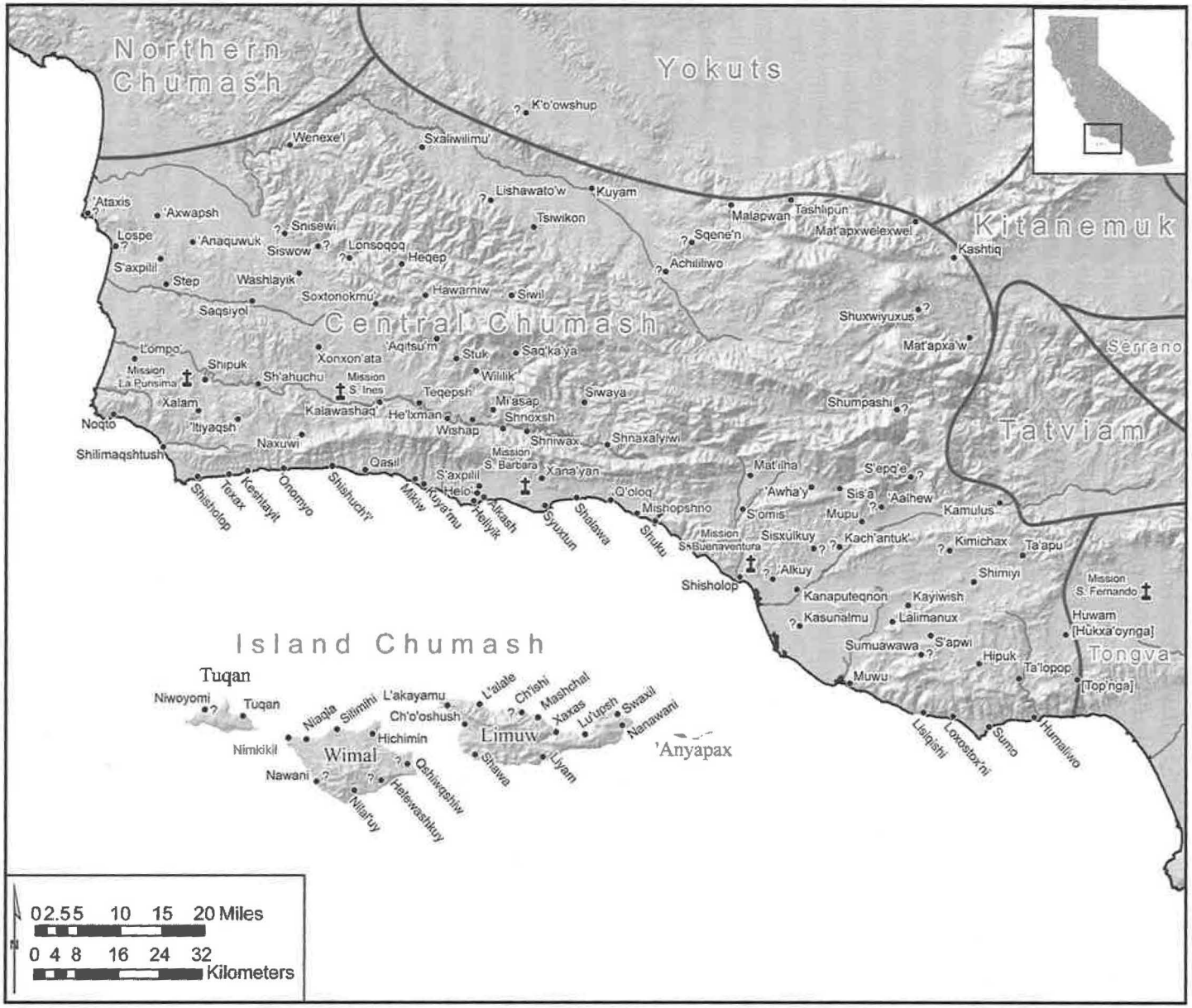

Figure 13.4. Approximate location of tribal groups, Northern Bight region (after McLendon and Johnson 1999).

Arnold and Graesch 2001; Arnold and Munns 1994; Arnold et al. 2001; Preziosi 2001) through analysis of large collections of microblades, microblade drills, bead manufacturing detritus, and beads. As a result of this research, it is now apparent that from about cal A.D. 1200 until missionization, island populations were the exclusive manufacturers of literally millions of shell beads. The beads were perforated by drill tips made from chert microblades, most of which were manufactured in large quantities at villages in the eastern sector of Santa Cruz Island. The exchange of the beads for mainland products, and the intensive use of the beads in exchange relationships throughout mainland Chumash territory and beyond, resulted in one of the most developed regional economic exchange systems in North America.

Arnold and her colleagues (Arnold and Graesch 2001; Arnold and Munns 1994) suggested that the manufacturers of shell beads and microblades became specialized during the Middle/Late Period Transition, cal A.D. 1150 to 1200, although a smaller-scale expansion appears to have occurred about 200 to 400 years earlier, perhaps coeval with the advent of microblade drill manufacture (Kennett 2005:202–206). Beginning about cal A.D. 1200 the more costly and time-consuming *Olivella biplicata* callus beads began to be made, a type that has been identified as a monetary currency at the time of European contact (Arnold and Munns 1994; Arnold and Graesch 2001:80; King 1976). Arnold (1987:220; Preziosi 2001:157–161) also noted a shift at this time in microblade production, from trapezoidal forms produced in the later Middle Period to prepared triangular forms manufactured in the Late Period. In conjunction with this shift, Arnold suggests that the centers of microblade production were reorganized, with centralization of the industry on Santa Cruz Island.

Arnold (1992a, 2001c) and Munns and Arnold (2002) also examined settlement patterns at this time and noted that relatively few sites on Santa Cruz Island have been securely dated to the Middle/Late Transition Period. Arnold (1992a:76) proposed that several Middle Period settlements on Santa Cruz Island were suddenly abandoned about cal A.D. 1200–1300. Furthermore, Munns and Arnold (2002) suggest that fish supplanted shellfish as a dietary mainstay at about this time. As well, osteological evidence indicates an overall decline in health and an increase in violence (Lambert 1994). This lasted until about cal A.D. 1300, when Munns and Arnold (2002) suggest that violence decreased and the health of inhabitants improved.

Significant archaeological work also has occurred on Santa Rosa and San Miguel Islands. Kennett (1998) and Kennett and Conlee (2002) stated that the earliest evidence for settled villages on these islands occurs at about cal A.D. 650. Kennett (1998, 2005; Kennett and Conlee 2002) noted that some settlement locations on these islands were disrupted between cal A.D. 1150 and 1300, perhaps because of drought (Kennett and Conlee 2002). However, after this period, many of these same settlement locations were reoccupied. The dietary importance of fish increased after cal A.D. 950 and remained important thereafter. As well, evidence of bead making dates to this time on eastern Santa Rosa Island. On San Miguel Island, the production of mortars and pestles at 16 sites increased in importance after cal A.D. 650. A greater emphasis on territoriality appears to have begun around cal A.D. 650, seemingly related to competition for terrestrial resources, especially freshwater (Kennett 1998; Kennett and Conlee 2002; Kennett and Kennett 2000).

Evidence for climatically induced change along the Santa Barbara Channel mainland coast is not as definitive as appears to be the case on the Northern Channel Islands. Part of the reason is the lack of systematic, focused attention on the post cal A.D. 1000 period on the mainland, but the inability to distinguish between Terminal Middle Period and Late Period deposits due to rodent disturbance is another obvious reason. The Corral Canyon site (SBA-1731), one of the few with intact stratified deposits, dates between cal A.D. 500 and 1600, therefore spanning the Middle/Late Transition (Erlandson and Rick 2002a). Erlandson found that the faunal and floral assemblages at the site were diverse, including an abundance of fish and sea mammal remains, and that the site shows "little evidence of unusually warm water temperatures or any serious degradation of the marine environment" (Erlandson and Rick 2002a:175–176). The faunal assemblage at the Pitas Point site (VEN-27), a mainland coastal site in the Ventureño Chumash region occupied between approximately cal A.D. 1000 and 1500 (Gamble 1983), provides additional evidence of subsistence during the Middle/Late Transition. Ongoing analysis of the fish remains (Shalom 2005) indicates a diverse assemblage of fish, with numerous pelagic species. The assemblage indicates that there was no shortage of fish during this time interval. In addition, Walker's analysis of sea mammal remains from the site (personal communication, 1997) revealed that forelimb bones of fur seal were much more common in deposits dating between cal A.D. 1000 and 1150 than in deposits dating to the

later years of occupation. He suggested that these cuts of meat were traded from the Channel Island rookeries to the site during the late Middle Period.

There is also evidence for the specialized manufacture of artifacts at both sites. At Corral Canyon, 1,460 fragments of *Olivella biplicata* shell indicate that the inhabitants were making cup beads from the callus portion of the shell (Erlandson and Rick 2002a). The density of bead detritus from this site is higher than that from any other mainland channel site and overlaps the lower range of densities in sites on the Northern Channel Islands (Arnold and Graesch 2001). At the Pitas Point site, over 650 tarring pebbles used to line the interior of water bottles with asphaltum were collected. In addition, a basket-making activity area was found in a probable Middle/Late Transitional period level in one of the houses (Gamble 1983). Water bottles may have been produced for export in response to drought-induced water scarcity in other areas of the Santa Barbara Channel (Gamble 2005:100). Also, Wake (2001:196) noted evidence for the manufacture of deer bone tools at the Pitas Point site and suggested that awls and other bone implements may have been produced there and then traded to Santa Cruz Island.

The presence of several large Late Period settlements along the Santa Barbara mainland coast indicates that regional population probably reached its peak during this period, although accurate population estimates are not available. This larger population size may be related to the earlier development of important subsistence technologies (discussed earlier) and economic exchange networks that allowed villages not only to cope more effectively with hard times but also to grow (King 1990; Erlandson and Rick 2002a; Glassow 1996a). Arrow points also changed in form around the beginning of the Late Period or slightly before. The leaf-shaped form was replaced with a concave base form typical of many regions of California and the Great Basin (typically called the cottonwood triangular type, Figure 13.3). This change in point form correlates with the abandonment of the use of asphaltum in hafting.

At the time of European contact, the Chumash of the Vandenberg region were not as complex as those living along the Santa Barbara Channel. Glassow (1996a, 2002a) proposes that this was due in part to the absence of plank canoes north of Point Conception. As was the case along the Santa Barbara Channel, populations in the Vandenberg region probably grew during the course of the Late Period. The population in this region abruptly began to rise after cal A.D. 600 and peaked during the Late Period (Glassow 1996a:101, 2002a:200–203). Associated with population growth was a refinement of technology and intensification of subsistence, although the use of maritime resources in the Vandenberg region was rather conservative in comparison to the channel region (Glassow 2002a:191). Shellfish remained the principal food (70 percent of the protein) throughout the Late Holocene. Nonetheless, fishing from shore, probably using hooks and nets, became relatively more important after cal A.D. 1200, as did intensive hunting of aquatic birds from lagoon habitats.

Changes in subsistence in the Vandenberg region also correlated with changes in settlement patterns, with more sites situated in a greater diversity of environmental situations during the Late Period. The high density of sites and diversity of locations indicates a high degree of mobility (Glassow 2002a:192), but this period is also characterized by longer-term principal residential bases, such as at the village site of Noqto (SBA-210) (Glassow 2002a:194).

Population growth in the Vandenberg region also may be related to more intensive economic exchange (Glassow 2002a). The increased density of shell beads and ornaments imported from the Santa Barbara Channel area, including *Olivella* callus cups, in sites occupied after cal A.D. 1200 indicates that Vandenberg populations participated in the regional money-based economic system concentrated along the central Santa Barbara Channel coast, but did not manufacture the beads on which the system was based. Archaeological evidence does suggest that large, high-quality Monterey chert bifacial preforms (Arnold 1992b) were manufactured at Vandenberg sites for exchange to adjacent regions, where they may have been used to make the knife and harpoon points that are common in Late Period sites (Glassow 1996a:142, 2002a:198). In summary, Glassow (2002a:203) suggested that the changes in Late Period society in the Vandenberg region may be linked to local population growth, possible immigration (Glassow 1996a:138), and external processes and events that took place along the adjacent Santa Barbara Channel.

As was the case in the Vandenberg region, population in the inland area of Santa Barbara County, including the central Santa Ynez Valley watershed and the mountain ranges and canyons northward to the margins of the Carrizo Plain, was not as dense as along the Santa Barbara Channel coast. An important question addressed by archaeologists who have investigated sites in this region is the relations between occupants

of these inland areas with populations along the channel coast. Spanne (1975) suggested that populations from the coast migrated to the interior during the winter to take advantage of steelhead trout run on the Santa Ynez River. During the summer inland groups migrated to the coast to fish in the Santa Barbara Channel. Others (Glassow 1979; Tainter 1971a, 1972, 1975) have also considered implications of the inland-coastal seasonal variation in resource availability, but have suggested instead that the strategy employed was exchange of subsistence resources, not movement of people (Horne 1981; Macko 1983; McRae 1999).

Horne (1981) proposed that by the Middle Period, occupation of the inland region was based on a seasonal round centered on larger residential bases. Population likely expanded during the Middle Period, probably in association with increasing differentiation in social and economic roles, as was the case along the Santa Barbara Channel. Exchange with coastal villages and intervillage social and political ties based on marriage, which ethnohistorical studies have documented, probably had its origin sometime during the Middle Period (Horne 1981:194–195). Horne (1981:56) noted the increasing complexity of exchange during the Late Period, with the development of regional craft specialization and religious practices analogous to those along the channel coast.

Several sites provide subsistence and other data that can be used to evaluate Horne's propositions. The site of Xonxon'ata (SBA-3404; Hildebrandt 2004) has provided critical data for understanding not only subsistence but also exchange relationships with the coast. The fish assemblage is dominated by species well suited for exchange, such as sardines and anchovies (83 percent). The shellfish assemblage is dominated by mussels (70.4 percent), which were probably transported whole and alive from the coast, a distance of 27–33 kilometers. Other inland sites, such as SBA-485 (Macko 1983) and SBA-2358 (Anderson 1997), show a similar pattern of abundant remains of small schooling or other fish and shellfish.

Other items derived from the coast at Xonxon'ata include stone bowl fragments of steatite probably from Santa Catalina Island and numerous shell beads, many of which are *Olivella* cupped beads. Hildebrandt (2004:80) suggested that the coastal-interior exchange network during the Late Period may have become more important when interior population densities increased to a point at which local deer herds became depleted and the need arose for nonlocal sources of meat. The faunal assemblages from the Xonxon'ata site and other inland sites, such as SBA-485 (Macko 1983), are consistent with this proposal in that lagomorph bones are far in excess of artiodactyl bones. Collections from another inland Chumash village site provides a contrasting picture. The site of Soxtonokmu' (SBA-167), occupied from the Late through Historic Periods (cal A.D. 1500 to 1804), has a relatively high frequency of deer bone and low frequency of shellfish remains and fish bone (McRae 1999:129). Unlike other inland sites that may not have had enough deer meat available, it is possible that the inhabitants of Soxtonokmu' did not need as much coastally derived fish and shellfish to supplement their diet. Basketry and deer bone tools may have been produced at the site for trade with other villages, including coastal settlements.

The available evidence from inland sites, although still sparse, indicates that the area had relatively dense population by the end of the Middle Period, as well as exchange relationships with the coast that apparently expanded during the Late Period. The goods traded between inland and coastal villages probably included such items as toolstone, basketry, bone tools, and pine nuts, but the commodities traded undoubtedly varied, reflecting the environmental diversity that characterized the inland area. Based on the size and internal organization of Late Period sites and limited mortuary data, it is likely that ranked social organization existed in the inland communities, similar to that seen in coastal villages.

The Santa Monica Mountains and interior valleys within and immediately to the north are separated from the Santa Barbara Channel and the inland areas north of the channel by the broad, low-lying lands on either side of the Santa Clara River mouth. Although Late Period coastal villages in this region were not as large as those along the Santa Barbara Channel mainland coast, patterns of settlement, subsistence, and social organization were generally similar (Gamble and Russell 2002). Population size peaked during the period after cal A.D. 1000, and settlements were integrated into regional sociopolitical organizations based on hereditary ranking (Gamble et al. 2001), specialization, and exchange. Sedentary coastal settlements were linked through exchange of fish and other resources with smaller settlements located in the interior valleys (King 1990; Gamble and Russell 2002).

There is some disagreement over the nature and degree of sedentism among late prehistoric inland populations of the Santa Monica Mountains. King (2000:75) identifies the presence of permanent prehistoric inland villages and notes that botanical evidence

from the inland village of Talepop (LAN-229) is indicative of year-round occupation. In contrast, Van Horn (1987:63–74) suggests that there were no large, permanently occupied settlements in the interior; rather, population centers were located on the coast with only a few scattered semipermanent villages in the interior. Dillon and Boxt (1989:152–159) suggest a shifting village or rancheria model of settlements in the Santa Monica Mountains and interior valleys. They propose that permanent inland villages did not exist and that population congregated into larger settlements during winter months and dispersed as small family groups during the late spring and summer months.

At the time of European contact, the Tongva occupied the Los Angeles basin and lands immediately north. Takic-speaking people apparently expanded into the Los Angeles basin relatively late in prehistory, although archaeologists' opinions differ with regard to the timing of this expansion (see Chapter 6 in this volume). A recent analysis of skeletal collections from the Southern Channel Islands indicates that Takic-speaking people likely replaced earlier populations who spoke an unrelated language sometime around 500 cal B.C. (Kerr 2004:139), although the replacement surely would have been earlier on the mainland.

It has often been assumed that the Tongva had settlement systems, subsistence strategies, and social organizations similar to but not as complex as their northerly Chumash neighbors. This argument is based largely on the projection of ethnohistoric and ethnographic data into the past (Bean and Smith 1978; Hudson 1969, 1971; McCawley 1996). Following this logic, scholars have argued that the Tongva lived in politically autonomous, socially stratified villages with populations of approximately 150 people. Systematically recovered archaeological data that support such a conclusion are minimal, possibly due in part to the destruction of village sites by urban development. Recent archaeological research (Grenda and Altschul 2002a) provides a somewhat different picture: habitation sites were hierarchically organized around estuaries (Grenda and Altschul 2002a:128) but settlement sizes were highly variable across the basin, reflecting resource availability. Grenda and Altschul (2002a:129) suggest that some estuaries supported large habitation sites, while others were characterized by a rancheria pattern of linked but dispersed small habitation sites. Grenda and Altschul (2002b:166) also maintain that populations at smaller estuaries practiced a strategy of mobility, with at least part of the population dispersing to forage in other areas during periods of resource stress. Research on subsistence remains from the Playa Vista/Ballona Creek area (Altschul et al. 1992; Becker 2003; Grenda et al. 1994; Maxwell 2003) supports the idea that subsistence practices focused primarily on local estuarine, coastal, and near-coast resources. This research identifies a generalized subsistence base of a broad mix of terrestrial and marine resources with a shift from lagoon to sandy shoreline shellfish species as lagoon environments silted in. Fishing concentrated on nearshore environments with relatively little exploitation of deep-sea resources (Maxwell 2003; Salls 1985a, 1987; Salls and Cairns 1994).

Based on the distribution of similar stone effigies (Gamble and Russell 2002), it appears that the prehistoric Tongva shared at least some aspects of ritual with the Santa Monica Mountains Chumash to the north. In contrast, the presence of some cremations at Tongva sites during this period, which are essentially absent at Chumash sites, indicates a degree of social separation from the Chumash, despite interaction with other Takic-speaking groups to the east and south (Gamble and Russell 2002).

As the Spanish began to explore and eventually colonize the Northern Bight, the Chumash and their Tongva neighbors had the most complex political and economic organization in California, and, for that matter, in all of western North America. Johnson (2000) was able to elucidate important aspects of this complexity through his extensive analysis of mission register data, particularly through consideration of geographic patterns in intervillage marriages. His analysis indicated that politically independent households and villages in different environmental zones were linked through marriages and matrilocal residence, which would have served as the basis for an exchange system that distributed goods throughout the Northern Bight and beyond. As King (1976) had argued, this exchange system minimized localized subsistence stress resulting from climatic fluctuation through distribution of resources from one area to another.

WHEN DID COMPLEX SOCIOPOLITICAL, RELIGIOUS, AND ECONOMIC SYSTEMS DEVELOP IN THE NORTHERN BIGHT?

Although important changes in economic organization occurred during the Middle/Late Transition, particularly with regard to the production and use of shell bead money, there is clear evidence of social and political complexity prior to the transition. This evidence is manifest in mortuary practices, religious artifacts, sweat lodges and houses, and the nature of

the plank canoe. Compelling evidence from mortuary contexts for the existence of a ranked society with a hereditary elite is apparent at least by the late Middle Period in the Santa Barbara Channel area (Gamble et al. 2001, 2002). Bioarchaeological data from a cemetery at the coastal site of Malibu (LAN-264) dating to Middle Period Phase 5 (cal A.D. 900 to 1150) indicate that ranking and hereditary leadership had emerged at least by this time.

Evidence from other sites with mortuary data point to ranking and hereditary leadership prior to the Late Period. A burial from Mescalitan Island (SBA-46) that dates to Middle Period Phase 5c (cal A.D. 1050 to 1150; Glassow et al. 1986) is indicative of significant social complexity. The burial was originally found in a flexed position face down on the surface of a whalebone scapula that was elaborately decorated with hundreds of inlaid shell beads and ornaments. Other elaborate grave offerings included hundreds more shell beads, a wide-mouth sandstone bowl mortar with inlaid beads, a large stone tubular bead with inlaid shell disk beads, other tubular stone beads, and abalone ornaments (Orr 1943).

It is also of interest that subterranean sweat lodges were used throughout the region at least by the Middle Period and eventually became standardized in their shape and appearance (Gamble 1991, 1995). By the Historic Period, sweat lodges in the interior and coastal areas of the Chumash region were almost identical in appearance, as can be seen in examples at H'elexman (SBA-485) in the Santa Ynez Valley, Mikiw (SBA-78) on the mainland coast, Wenexe'l (SLO-94/95) in the Cuyama River valley, and the Mathews site (excavated by W. D. Strong in the 1930s), also in the Cuyama River valley.

The plank canoe *(tomol)* was a complex watercraft, entailing sewn-plank technology, by 1500 years ago, if not centuries earlier (Gamble 2002b). The *tomol* was not only important in the intensification of maritime subsistence, but was also central to an interregional system of exchange. Significant items exchanged throughout southern California and even farther by the end of the Middle Period included not only shell beads and ornaments but also steatite artifacts, chipped stone materials, mortars, pestles, and red ochre.

In summary, a great deal of sociopolitical, economic, and religious complexity clearly existed during the latter part of the Middle Period, and significant elements of this complexity originated centuries earlier. Much of the disagreement regarding the nature of this complexity revolves around when hereditary leadership originated. It seems likely that differences in interpretation of the existing data will be resolved once models of hereditary leadership and its development become more diverse and incorporate greater detail about how it operated over the course of time.

CONCLUSION

Compared to other regions of California, prehistoric cultural systems of the Northern Bight are distinctive in certain respects. As many have pointed out over the years, the relatively quiet waters of the Northern Bight, particularly in the Santa Barbara Channel, allowed for the use of watercraft for marine fishing and commerce between the mainland coast and the Channel Islands. It is also significant that nowhere else in California were islands inhabited by populations that articulated socially and economically with the mainland. This juxtaposition of islands (including the Northern Channel Islands and Santa Catalina Island) and the mainland gave a distinctive flavor to the prehistory of the Northern Bight, particularly later in prehistory as islanders began to manufacture quantities of craft items of interest to mainlanders.

The prehistory of the Northern Bight also extends farther back in time than is the case in most other regions of California, and prehistoric cultural systems span an unusually wide spectrum between simple and complex. The earliest peoples of the Northern Bight appear not to have had sociopolitical or economic organizations any more complex than found elsewhere in California, although they may have been living at higher densities. Beginning around 4,000 years ago or shortly afterward, the first strong hints of social and economic complexity are manifest, although on a moderate scale. From then on, signs of complexity become more obvious and diverse, and by the time of European contact, the Chumash and their coastal Tongva neighbors had hereditary political offices and a social elite, different sorts of regional organization, and a well-developed shell bead currency that facilitated intervillage and cross-channel commerce. With regard to the latter characteristic, nowhere else in California was a regional economy as monetized as in the Northern Bight, even though shell bead money was used throughout California.

Northern Bight prehistory also witnessed significant technological changes that affected many aspects of ecological adaptation, society, and economy. These include the mortar and pestle, shell fishhook, harpoon, plank canoe, bow and arrow, and microblades.

Of these, the plank canoe and microblades are not shared by other California groups, and both are intimately associated with the rise of complex sociopolitical organization, microblades being used in the manufacture of shell beads on a relatively large scale and plank canoes requiring considerable investments of time and expertise in their manufacture, let alone their facilitation of cross-channel commerce. Both reflect the importance of offshore island populations in the development of complexity.

It is not surprising that archaeologists working in the Northern Bight over the past 20 years have been concentrating their attention on the evolution of complex sociopolitical and economic organization. Moreover, it is not surprising that most of this attention has been focused on the developments over the last millennium, when different archaeological manifestations of complexity are most apparent. As we have emphasized, however, complexity has deep roots in the region's prehistory, and it is certainly worth considering its earlier forms in order to develop a fuller picture of its evolution and to explore the various determinants of this evolution. One of the variables underlying the evolution of complexity in the Northern Bight is population growth. We have pointed out that population growth becomes obvious beginning sometime around 1,500 years ago, and it seems likely that relatively high levels were reached by 1,000 years ago. The development of new subsistence technology, including particularly the mortar and pestle, shell fishhook, and plank canoe, allowed expansion of the resource base to include new foods and greater access to foods already part of the diet. Although archaeological evidence is circumstantial, food storage, particularly of acorns and dried fish, undoubtedly had become important as well. Consequently, increasing numbers of people could be supported within the Northern Bight. The expansion of regional economic systems involving various manufactured items such as shell beads, which could be exchanged for food resources, may also have played a role in supporting population growth.

Another focus of interest developing over the past 20 years has been the role of environmental change in fostering or triggering cultural change. A fundamental problem in attempting to explore the relationship between these two realms of change has been the specificity of paleoenvironmental records. The water temperature and marine productivity records produced by Kennett and Kennett (2000; Kennett 2005) are impressive in their detail and the trend patterns they display. However, they are not direct records of the distribution and abundance of specific kinds of food resources on which prehistoric people depended. Models that make the translation between the records and food resources are still rudimentary, and as a result the arguments made by archaeologists regarding the effects of environmental change on subsistence are necessarily simplistic (Gamble 2005). A related problem is that paleoenvironmental records do not inform on all relevant aspects of the environment. For instance, the Kennett and Kennett (2000) records pertain to marine productivity but not necessarily to terrestrial productivity. The controversies over the past two decades surrounding the role of environmental change discussed above generally revolve around interpretation of paleoenvironmental records and the kind of impact, if any, that environmental change had on cultural systems, particularly in the realm of subsistence. The resolution of these controversies probably will not be forthcoming until new or refined paleoenvironmental records become available and archaeologists develop more explicit models of resource utilization and its effect on different realms of cultural behavior.

Looking to the future, archaeology will continue to make progress in understanding the prehistory of the Northern Bight, but the rate of progress depends on whether several important issues are addressed. First, as is true of regional archaeological programs elsewhere in California, attention must be given to reevaluating and refining chronology. Many conclusions about the chronology of a site's occupation are based on a few radiocarbon dates, which may mean that some interpretations about the course of prehistory are simply wrong. The difficulty with chronology is particularly acute with regard to drawing conclusions about relatively short time spans such as the Middle/Late Transition and the time intervals immediately before and after.

Second, inland areas of the Bight, particularly the larger valleys that contain many sites, need substantially more attention. The number of investigated sites is very low in most inland watersheds, and knowledge of their prehistory is meager. Considering the exchange relationships that existed between inland and coastal areas throughout prehistory, and the possibility that coastal and inland areas were joined in one settlement system during earlier periods of prehistory, knowledge of regional prehistory will remain skewed without more knowledge derived from inland sites. However, such sites offer archaeologists some difficult challenges in that many lack obvious organic materials

that may serve as radiocarbon samples. This is especially the case with sites dating to the Early and Middle Holocene. More intensive recovery techniques than have been typical may need to be applied to obtain datable material.

Third, it makes sense to continue the relatively high level of archaeological activity on the Channel Islands, which began about 20 years ago. Much of the recent focus on the Channel Islands is a result of significantly greater access in comparison to mainland areas, but the needs of CRM programs have also driven much of this research. Nonetheless, this island focus has important implications for elucidating the prehistory of the Northern Bight as a whole. Because sites have not been disturbed by land development and there are no rodent burrowing problems, the prospect for building high-resolution chronologies is substantially greater than on the mainland. As a consequence, knowledge of prehistory on the Channel Islands will provide a basis for a better understanding of the relatively more blurred prehistory on the mainland.

We can also expect future archaeologists to devote greater attention to some of the theoretical arguments prevalent within archaeology today. Currently theories derived from evolutionary and behavioral ecology and others concerned with social and political organization are commonly employed in developing explanations for cultural change and diversity in the Northern Bight. As more control is gained over chronology and as new or refined measures of human behavior are developed, applications of these theories will become more explicit. The region's archaeology will likely allow new theoretical constructions to be developed, particularly because the Northern Bight's archaeological record is so rich and diverse and spans such a long period of prehistory.